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Theory of Longitudinal Beam Halo in High Current Ion RF Linacs[1] JOHN J. BARNARD, STEVEN M. LUND, *LLNL* — Ion linacs with high beam current and duty factor are being considered for applications such as the production of tritium and the transmutation of radioactive wastes. Because beam particle losses can be problematic in these applications, the structure and control of the so-called halo components of the particle distribution surrounding the beam core is a critical issue. Recently, the understanding of the structure and control of transverse beam halo has been advanced through analytic theory and numerical simulations. Here, we present ongoing theoretical and numerical work on longitudinal beam halo. A core/test particle model is employed to calculate longitudinal trajectories of on-axis test particles in the presence of longitudinal focusing fields from the rf bucket and space charge defocusing fields under the assumption of uniformly distributed charge within an ellipsoidal beam envelope that is azimuthally symmetric. The ellipsoidal beam envelope undergoes coupled longitudinal-transverse mismatch oscillations. Conditions for particle ejection are analyzed. Averages are taken over rapidly varying components of the amplitude-phase equations describing the particle orbits to determine the structure of the longitudinal halo formed by a resonance between twice the particle oscillation frequency and a slow envelope oscillation mode.

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☐ Prefer Oral Session
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